Komunitas ikan padang lamun di Perairan Laimeo, Kendari, Sulawesi Tenggara. Hairati Arfah & Abd. Wahab Radjab 256-263

Diversity and abundance of fishes in relation to position of seagrass beds within an estuary: comparison between Tuggerah Lake and Lake Macquarie, NSW, Australia. Khairul Amri 264-271

Budidaya ikan kerapu (Serranidae) di perairan pesisir Teluk Kodek, Desa Malaka Lombok Barat. Langkosono 272-279

Vibration analysis of underwater towed system. Mansyur Hasbullah & Naomi Kato..... 280-288

Pemetaan objek dasar perairan dangkal Pulau Kapoposang dengan menggunakan Landsat ETM. Muhammad Banda Selamat & Jamaluddin Jompa 289-295

Pengaruh kandungan zooxantela terhadap karakteristik reflektansi spektral karang. Nurjannah Nurdin 296-305

Benefit analysis of electric lift net and share yield system. Sutinah Made 306-311

Kelimpahan dan distribusi spasial fitolankton dan zooplankton di perairan Belitung Barat pada musim timur. Tumpak Sidabutar 312-321

Volume 16 Nomor 5 (Special Edition: CCRC-UH) **December 2006**

Analytical framework for integrating the *ponggawa-sawi* institution into co-management. Dewi Yanuarita & Muhammad Yusran Nur Indar 322-333

Growth rate and productions of tropical seagrass *Enhalus acoroides* L. f. Royle in the vicinity of fish cage in Awerange and Labuange Bays, Barru Regency, South Sulawesi. Dody Priosambodo 334-345

The effect of different electrode voltages on transplanted coral growth rates and mineral accretions. Jamaluddin Jompa, Suharto & Aidah A. A. Husain..... 346-352

Growth rate of brown seaweed *Sargassum echinocarpum* in Awerange and Labuange Bays, Barru, South Sulawesi. Khairul Amri & Muhammad Ilyas..... 353-358

Macroinvertebrates associated with seagrass at Awerange and Labuange Bays South Sulawesi. Magdalena Litaay..... 359-367

Oceanography of coastal waters around fish cages in the Labuange and Awerange Bays, South Sulawesi. Mahatma Lanuru..... 368-374

Spatial and seasonal distribution of macroalgae in Awerange and Labuange Bays, Barru Regency, South Sulawesi. Muhammad Ilyas & Khairul Amri..... 375-380

Socio-economic and institutional conditions of costal communities in North Maluku Province. Muhammad Yusran Nur Indar 381-392

Community structure of seagrass in Awerange and Labuange Bays, Barru Regency, South Sulawesi. Sayuri Sarinita & Dody Priosambodo 393-402

Spawning of the topshell (*Trochus niloticus* L.) using different induce methods. Syafyudin Yusuf, Magdalena Litaay, A. Niartiningsih, Budimawan & Fatmawati..... 403-408

SPAWNING OF THE TOPSHELL (*Trochus niloticus* L.) USING DIFFERENT INDUCE METHODS

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ABSTRACT

The topshell (*Trochus niloticus* L.) is one of the endangered species as it is near to extinction in nature, due to fishery activities, without concerning its conservation. One of the alternatives to prevent the extinction of topshell is through seedling and spawning. This research was aimed to know successful rate of topshell spawning using different induce methods. Four methods were used to stimulate spawning: shock temperature, strong aeration, running sea water and a combination method (shock temperature and running sea water). The results showed that running sea water was more effective method to induce spawning of the topshell. While shock temperature with temperatures of 37 – 38oC or 4 -5oC above ambient temperature result in death of breeders. Accordingly, strong aeration is also alternative method in inducing spawning of the topshell.

Keywords: spawning, topshell, induce methods

INTRODUCTION

Topshell (*T. niloticus* L.) is one of commercial species in Indonesia. The shell has been used in many industries such as: cosmetics, ceramic, jewelry, glass and others (Dharma, 1988). While its meat is consumed by islanders due to various benefits. This group has been exploited extensively, lead to depletion of wild stock in many places. Nowadays, this group is categorised as endangered species (Sukarno, 1993). Topshell fishing of *T. niloticus* in Indonesia is prohibited as stated in Forestry Ministry Decree No 12/Keptan-II/1987 and Indonesian Constitution No 301/KPTS-II/1991 (Departemen Kehutanan, 1993).

Dahuri *et al.* (2004) suggested that one of methods in restoration of destructive ecosystem is through aquaculture activity. Hatchery production of this species has been practised in Pacific Island and Australia using different methods according to local conditions.

Running seawater as induced spawning method with succesful spawning of 66-90% has been recorded in Korsae. Temperature shock is the other spawning method by drowning the animal into warm water. However, the late did not give a good result as Koarse has due to high

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rain fall (Tsutsui & Sigrah, 2000). Artificial spawning has been successfully conducted at LON-LIPI Ambon (Pradina *et al.*, 1997). In 2002, Department of Aquaculture in the Philippines spawned topshell using the combination of running sea water and temperature shock on 40 topshell spawners and produced 337,000 veliger larvae from 2 millions eggs. Then in the same month, the department conducted spawning using running sea water and temperature shock methods separately, and produced 319,000 veliger larva from 2.6 millions eggs for running sea water method (Aquaculture Dept. of Philippines, 2002).

The study was aimed to know succcessful rate of spawning of topshell (*T. niloticus*) using different spawning inducer. The results are expected to contribute to the knowledge on hatchery production, especially on the effective spawning method in order to support conservation program of endangered species in Indonesia.

METHODS

Two spawning batches were conducted: (1) on September 2005 and (2) on April 2006 at the Hatchery of Barrang Lompo Island, belongs to University of Hasanuddin, Makassar, Indonesia. Breeders were obtained from surrounding waters and number of breders used in the experiment was limited due to current status of the topshell. The topshell is endangered species, therefore two batches of spawning was conducted.

Induced Spawning Methods

Four spawning methods were applied in this study, those were, (1) temperature shock; (2) strong aeration; (3) running sea water and (4) combination of temperature shock and running sea water. The shells of breeders were cleaned from epiphytes before spawning treatments. Treatments of breeders as follows:

a. *Temperature shock*: Topshells were left in open air and sunlight at temperature around 37-38°C, for approximately 1 hour. Then the topshells were placed in a spawning aquarium at normal water temperature of 28 -.29°C.

b. *Strong Aeration*: Experiment I gave strong aeration for 4 hours and 26 minutes, while Experiment II run for 4 hours. Topshells then moved to a spawning aquarium with temperature of 28-29 °C.

c. *Running Sea Water*: Topshells were placed in an aquarium that has a running water. For Experiment I, the water was running for 5 hours with the debit of 5,25 litres/minute.

d. *Combination of temperature shock and running water*: Topshells were given temperature shock by exposing it to sunlight and open air for 1 hour and 20 minute under 37°C-38°C. They were subsequently immersed into a running sea water and then into prepared spawning container.

Observations were done on :

a. Response to induced spawning to different treatment

b. Survival rate of spawning Topshellt different treatment

c. Release of sperm and eggs at different treatment.

In addition, the following formulas were used to count fecundity, spawning success (%) and survival rate.

- Fecundity: number of egg/individual spawner

- Percentage spawning: number og spawner/number of breeders used x 100%

- Survival rate: number survived breeders after treatment/total number of spawners x 100%

RESULTS AND DISCUSSION

Induce Spawning

The results of different spawning methods on the successful spawning of *T. niloticus* are shown in Table 1.

Table 1. Number of spawners and successful spawning of *T. niloticus* using different induced spawning methods

No	Induce Methods	Number of Breeders		Percentage of Spawner (%)	
		Exp. I	Exp. II	Exp. I	Exp. II
1.	Temperature shock (TS)	10	8	0	0
2.	Running Sea Water (RSW)	10	7	40	43
3.	Strong aeration (SA)	10	8	0	25
4.	Combination (TS+RSW)	10	7	10	0

Table 1 shows that either experiment 1 and 2, induced spawning of topshell with running sea water treatment gave higher successful rates of 40 and 43 % as compared to other methods/treatments.

On contrary, spawning using temperature shock at both experiments showed no spawning reaction to each topshell (spawner). Temperature shock by exposing them to open air and sunlight caused death of topshells (spawner).

Survival Rate of the Spawner

Survival rate of topshell (spawner) using different spawning methods are shown in Table 2. Topshell (Spawner) with induced spawning using running sea water method is can survive with survival rate to 100% for both experiments. The combination method of temperature shock and running water yielded 50% survival rate for the first experiment while in the second experiment 0%. For temperature shock method, both experiments showed no survivor of the topshells (spawner), i.e., 0%.

Table 2. Survival rate of topshell (spawner) at different treatments.

No.	Induce Methods	Breeders survival (%)	
		Exp. I	Exp. II
1.	Temperature shock (TS)	0	0
2.	Running Sea Water RSW	100	100
3.	Strong aeration (SA)	100	100
4.	Combination TS+RSW	50	0

The death of topshell (spawner) at spawning experiment using the temperature shock method was due to overheating of topshell under 37 - 38°C for $\pm$ 1 hour 20 minute. According to Heslinga & Hilman (1981) temperature tolerance for topshell is 28 - 34°C. The period of 1 hour 20

minute might be too long for the topshell (spawner). While great difference between air temperature of 34°C and water temperature of 28°C caused excessive stress which in turn caused intolerable physiology changes of the topshell. This is marked by mucus produced by topshell (spawner) when being exposed to air and sunlight and then in water. Possible cause of death was the effect of immersion (change in physiology due to the change in the habitat, from natural coral reef to spawning container and then open air). The effect of immersion can cause dehydration, cut off of dissolved oxygen and other factors where topshell has direct contact with air and high temperature. This might lower topshell's immune system and survival capability. Exposure to open air also affects motebolisme processes and caused prolonged stress to water organisms and could cause death.

Runnning water is the induced spawning method with highest successful rate. For two experiments, the first one yielded 40% and the second one 43% survival rate (Table 1). Higher survival rate at the running water method relates to time/period and debit of the running water. The first experiment was conducted for 5 hours with debit of 5.25 litres per minute while the second experiment run for 6 hours with debit of 7.875 litres per minute.

Induced spawning method using running sea water is common in Indo Pacific countries such as Korsea with success rate to 66-90% (Tsutsui & Sigrah, 2000). Basically, running sea water method gives hydrostatic pressure to topshell spawner to induce spawning. This method is adopted from natural conditions of highest and lowest tide. Due to high difference between the tides, water runs faster than other times. These conditions could induce spawning of several organisms such as topshell.

According to Hahn (1999), tidal current could affect *T. niloticus* which lives in shallow water less than 5m depth. Coral reef area is habitat of high energy. Original habitat and high density of topshell shell are found in the edges of coral reef that is exposed to waves (McGowan, 1985).

Topshell spawning generally takes place in new moon and full moon period (Lee & Amost, 1997). A research done by Heslinga & Hilman (1981) showed that for a period of lunar cycle, topshell has 13 times spawning in one year. Spawning occurred 10 times during new moon phase and 3 times in the following month. This shows that spawning of topshell generally occurs during the highest tide (spring tide).

In strong aeration method, topshell spawner could survive in all experiments and 25% could spawn in the second experiment (Table 1). The difference for experiment 1 and experiment 2 might be due to the difference in time/duration of strong aeration. In experiment 1, strong aeration was given in ± 4 hours while in experiment 2, strong aeration was given for 8 hours. Basically strong aeration is similar to running sea water method, that is giving pressure to topshell spawners to release their gametes into the water. Strong aeration methods is also largely used in several places such as Ambon where 6-8 hours of strong aeration could induce several topshell spawners to spawn (Pradina *et al.*, 1997).

For induced spawing using the combination of temperature shock and running sea water, the successful rate of topshell spawners in experiment is up to 10%, and survival rate is half of the total number of topshell spawner (50%). Meanwhile in experiment 2 all of the topshell spawners died as in the temperature shock method. The cause of death for most of topshell spawners might be due to overexposure to high temperature (38°C) in a long period of time (1 hour 20 minute).

Release of Sperm and Egg

Spawning means the release of gametes (sperm and egg) into nature. Table 3 shows number of spawners that release sperm or egg. In the combination of temperature shock and running sea water methods, from 5 female and 5 male topshell spawners, only one female released egg in the first experiment. Whereas, in the second experiment, none of the topshell spawners released egg or sperm.

The results of the research conducted by Ambon Mariculture Laboratory in year 1994-1995 found that female topshell spawners had high frequency of spawning in March and December 1994, while in January, April and December 1995, female and male spawners had the same frequency of spawning.

Table 3. Number of spawners that release egg and sperm.

No	Induce Methods	Number of Breeders Exp I		Number of Breeders Exp. II	
		Sperm	Egg	Sperm	Egg
1.	Temperature Shock (TS)	0	0	0	0
2.	Running Sea Water RSW	1	3	1	2
3.	Strong Aeration (SA)	0	0	1	1
4.	Combination TS+RSW	0	1	0	0

Number of Eggs

Number of eggs produced from spawning in different methods is shown in Table 4.

Table 4. Number of eggs for each treatment.

No	Induce Methods	Exp I		Exp II	
		$\sum$ egg / method	$\sum$ egg / individu	$\sum$ egg / method	$\sum$ egg / individu
1.	Temperature shock (TS)	-	-	-	-
2.	Running sea water (RSW)	2.399.058	799.686	1.493.013	746.506
3.	Strong aeration (SA)	-	-	709.821	709.821
4.	Combination (TS+RSW)	767.835	767.835	-	-

It can be deduced from Table 4 that in the first experiment in September 2005, for running sea water method, 2.399.058 eggs were spawned from 3 spawners or 799.686 eggs per spawner.

In the second experiment (April 2006), from two succesful spawning methods namely running sea water and strong aeration, there is no large difference in number of eggs produced. In running sea water method, number of eggs produced by topshell spawner is 746,506 while in strong aeration method 709,821 eggs. The number of eggs produced in the second experiment is not so different from the first experiment. This shows that different spawning methods do not affect the number of eggs produced.

The number of eggs produced in each method generally similar to the results of previous researches. For example, the spawning with running sea water method in Palau could produced hundreds of thousands eggs per individu (Lee & Amost, 1997).

CONCLUSION

Conclusion from the present study is running seawater and combination of desiccation and running sea water can be used as spawning trigger for the topshell (*T. niloticus* L.).

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